CHAPTER 3 DEVELOPMENT OF AIRPORT CAPACITY

"The airport runway is the most important mainstream in any town."

~ Norm Crabtree

3 Development of Airport Capacity

The FAA's Office of Airport Planning and Programming serves as the principal organization of the FAA responsible for all Airports program matters pertaining to national airport planning, environmental and social requirements, airport grants, property transfers, passenger facility charges, and ensuring adequacy of the substantive aspects of FAA rulemaking actions relating to these programs. The Office of System Capacity participates in the planning of capacity strategies for major U.S. airports, which includes assessing the technical feasibility of new systems and equipment.

This chapter summarizes capacity enhancements that are being achieved through airport development, major airport construction projects and the analyses necessary to support airport development. These analyses include airport design team studies and airport capacity benchmarking, as well as quantifying the benefits of potential capacity projects. Chapter 3 also summarizes other programs and activities affecting airport development, and includes a description of the resources funding these activities.

3.1 Capacity Enhancement Through Airport Construction Projects

There are two main strategies for enhancing airport capacity: build new runways and maximize the efficiency of existing runways. In 2003, new runways were completed at Miami International, Denver International, George Bush Intercontinental, and Orlando International airports. Following are some highlights of these projects, which generally can take up to ten years to plan, construct and commission.

Miami's Runway 8/26 construction project, completed in September 2003, took 51 months—15 months for design and 36 for the contract awarding process and construction. It is estimated that this capital improvement will increase capacity by 20 percent in Instrument Flight Rule (IFR) and 10 percent in Visual Flight Rule (VFR) conditions. The airport anticipates returning to pre-September 11th traffic levels in 2006. The airport has also invested $161 million in further capacity enhancement for an airport that is challenged by a relatively confining space of 3,200 acres.

Denver opened Runway 16R/34L in 2003, which is the longest commercial runway in North America, measuring 16,000 feet long and 200 feet wide. The runway project began in 1989, but the project was stopped in 1995 and did not resume until October 2000. Construction costs were approximately $167 million. It is anticipated that this runway could increase runway capacity at an estimated level of 18 percent in VFR and 4 percent in IFR.

George Bush Intercontinental opened its new 9,000-foot runway, 8L/26R, in early 2003 at an estimated cost of $260 million. The new runway, has the potential to support triple simultaneous IFR approaches when this procedure is approved by the FAA. The new runway will improve VFR capacity by 35 percent and IFR capacity by 37 percent. The airport, opened in 1969, operates on 10,000 acres.

Orlando opened its fourth runway in 2003. The runway will enhance efficient airline operations, by providing a system for simultaneous IFR landings by three aircraft, which is known as "triple simultaneous approaches," expected to provide a capacity gain as high as 23 percent in VFR and 34 percent in IFR. This airport continues construction of a 345-foot above ground level tower, which will be the tallest air traffic control tower in the U.S.

3.1.1 Capacity Enhancement Through Construction of New Runways and Extensions

A number of the busiest airports have completed new runways or other runway construction projects over the past five years. Figure 3-1 shows that ten new runways were opened from

January 1998 to October of 2003. Another 22 construction projects were completed for the same period, including 18 runway extensions, 3 reconstructions and 1 realignment. There are 35 construction projects planned between November 2003 and 2008 shown in Figure 3-2, including the building of 11 new runways.

Figure 3-1 Completed Runway Construction Projects January 1998 to October 2003

Airport (ID)	New	Extension	Renovation	Reconstruction	Realignment	Year	Runway
Grand Rapids Gerald R. Ford International (GRR)					•	1998	17/35
Little Rock Adams Field (LIT)				•		1998	4L/22R
Milwaukee General Mitchell (MKE)		•				1998	7L/25R
Madison/Dane County Regional (MSN)	•					1998	3/21
Palm Springs Regional (PSP)		•				1998	31L/13R
Albuquerque International (ABQ)		•				1999	12/30
Austin-Bergstrom International (AUS)	•					1999	17L/35R
Greenville-Spartanburg (GSP)		•				1999	3L/21R
Philadelphia International (PHL)	•					1999	8/26
Memphis International (MEM)		•		•		2000	18C/36C
Palm Beach International (PBI)		•				2000	9L/27R
Phoenix Sky Harbor International (PHX)	•					2000	7R/25L
Norman Y. Mineta San José International (SJC)		•				2000	12L/30R
Des Moines International (DSM)		•				2001	5/23
Detroit Metropolitan Wayne County (DTW)	•					2001	4L/22R
El Paso International (ELP)		•				2001	4/22
Kahului (OGG)		•				2001	2/20
Phoenix Sky Harbor International (PHX)		•				2001	8L/26R
Albany County (ALB)		•				2002	10/28
Birmingham (BHM)		•				2002	5/23
Boise Air Terminal (BOI)	•					2002	9/27
Cleveland Hopkins International (CLE)	•					2002	6L/24R
Dayton International (DAY)		•				2002	6R/24L
Dallas-Fort Worth International (DFW)		•				2002	18L/36R
George Bush Intercontinental (IAH)		•				2002	15R/33L
Memphis International (MEM)				•		2002	18R/36L
Pensacola Regional (PNS)		•				2002	8/26
Sarasota Bradenton (SRQ)		•				2002	14/32
Denver International (DEN)	•					2003	16R/34L
George Bush Intercontinental (IAH)	•					2003	8L/26R
Miami International (MIA)	•					2003	8/26

Figure 3-2 Runway Construction Projects November 2003 to December 2008

Airport (ID)	New	Extension	Reconstruction	Runway Identifier	Estimated Cost ($M)	Planned Operational Year	In Progress
Orlando International (MCO)	•			17L/35R	$203.0	2003	•
Phoenix Sky Harbor International (PHX)			•	7L/25R	$66.0	2003	•
Norman Y. Mineta San José International (SJC)		•	•	12R/30L	$61.4	2003	
Cleveland Hopkins International (CLE)		•		6L/24R	$230.0	2004	
Greensboro Piedmont Triad (GSO)	•			5L/23R	$96.0	2004	
Minneapolis-St. Paul International (MSP)		•		4/22	$11.4	2004	
Louis Armstrong New Orleans International (MSY)			•	1/19	$31.5	2004	
Louisville International (SDF)		•		17R/35L	$18.0	2004	
Knoxville McGhee-Tyson (TYS)		•		5L/23R	$7.0	2004	
Albany County (ALB)		•		1/19	$7.5	2005	
Buffalo Niagara International (BUF)		•		14/32	$4.9	2005	
Greater Cincinnati International (CVG)	•			17/35	$233.0	2005	•
Greater Cincinnati International (CVG)		•		9/27	$18.2	2005	
Dallas-Fort Worth International (DFW)		•		17C/35C	$25.0	2005	
Fort Lauderdale-Hollywood International (FLL)		•		9R/27L	$898.0	2005	
Lubbock International (LBB)		•		8/26	$15.0	2005	
Manchester (MHT)		•	•	17/35	$65.0	2005	
Minneapolis-St. Paul International (MSP)	•			17/35	$563.0	2005	•
Fort Myers Southwest Florida Regional (RSW)			•	6/24	$15.0	2005	
Hartsfield Atlanta International (ATL)	•			10/28	$133.0	2006	
Boston Logan International (BOS)	•			14/32	$100.0	2006	
Cleveland Hopkins International (CLE)		•		6R/24L	$40.0	2006	
Norfolk International (ORF)	•	•		5R/23L	$120.0	2006	
San Antonio International (SAT)		•		3/21	$20.0	2006	
San Antonio International (SAT)		•	•	12L/30R	$11.0	2006	
Lambert St. Louis International (STL)	•			12R/30L	$1,100.0	2006	
Washington Dulles International (IAD)	•			1W/19W	$200.0	2007	
Indianapolis International (IND)	•			5R/23L	$80.0	2008	
Charlotte-Douglas International (CLT)	•			18W/36W	$187.0	TBD	
Dallas-Fort Worth International (DFW)		•		18R/36L	$400.0	TBD	
Manchester (MHT)		•		6/24	TBD	TBD	

See Appendix C for Runway Construction Projects 2009 and Beyond

3.2 Other Strategies For Improving Airport Capacity

In addition to new runway construction projects, the FAA assists airports in meeting peak demand through a combination of strategies that make better use of existing runways.

Several projects are underway to improve arrival and departure rates at OEP airports. In addition to building new runways, procedures will be evaluated for crossing runway configurations at 18 benchmark airports. Terminal airspace redesigns, planned for most of the benchmark airports and metro areas are aimed at improving the transition of arrivals and departures. Traffic management advisory tools that help in managing the arrival stream will become operational in four sites. Also, the multi-center capability will be evaluated in the Philadelphia area. An update of operational procedures is provided in Chapter 4 and Airspace Redesign is summarized in Chapter 5.

3.2.1 Airport Design Team Studies

The Office of System Capacity (ASC) helps to improve system efficiency by identifying and evaluating initiatives with the potential to increase capacity in the NAS. Among its many responsibilities, ASC supports Airport Capacity Design Teams. These teams evaluate alternatives for increasing capacity at specific airports that are experiencing or projected to experience significant flight delays. An airport study is the product of the Airport Capacity Design Team. Capacity studies are a crucial element in attaining funding for airport development projects. ASC also serves on teams that investigate other airport capacity enhancements, and participate in air traffic control simulations at the request of local and regional air traffic representatives and foreign airport operators.

3.2.1.1 The Dallas/Ft. Worth International Airport Perimeter Taxiway Demonstration

In an effort to reduce arrival and departure delays and the number of active runway crossings (with the added benefit of reducing the likelihood of runway incursions), a perimeter taxiway concept was proposed for DFW. A real-time human-in-the-loop (HITL) simulation was conducted on February 10-13, 2003, by a team consisting of the airport, the FAA, and NASA. This demonstration provided an opportunity to observe and experience the proposed airport improvements with realism and high fidelity, and generated a considerable amount of valuable data for analysis.

Currently, DFW experiences about 1,700 runway crossings per day, which contribute to arrival and departure delays and the potential for runway incursions. The primary objective of the simulation was to provide the airlines, air traffic controllers, and pilots and their unions the opportunity to observe and participate in a demonstration of the proposed airport improvements to gain support of the perimeter taxiways. The secondary objective was to collect and analyze operational data for the purposes of deriving descriptive statistics for runway crossings, taxi times, and pilot and controller transmissions. Overall, the data collected from the participants and the statistics demonstrated that the perimeter taxiways would improve operations in many areas, including average departure rates, average outbound taxi duration and associated runway occupancy times, average inbound and outbound stop rates and duration times, the number of runway crossings, and the amount of controller and pilot communications.

3.2.1.2 The Portland International Airport Study

Portland International Airport is ranked 34 in aircraft operations according to FY 2002 data, and is expected to experience a 26.6 percent increase in operations by 2010, according to 2001 Terminal Area Forecast baseline data. Recently, the Port of Portland decided to adopt low growth forecast figures for decisions regarding the timing of future facility enhancements. Using the Port's local forecast, the Portland International Airport Capacity Design Team updated its 1996 Capacity Enhancement Plan.

The first phase of this multi-phase effort had two goals: one was to evaluate the capacity and delay reduction benefits of the proposed third parallel runway, North/South taxiway and new technology. The second phase of the study, which was initiated in the fall of 2002, will further analyze the capacity and delay reduction benefits of the proposed third parallel runway by comparing the centralized and decentralized terminal options along with the reconfiguration of associated taxiways. The updated study will be completed in the late spring of 2004.

3.2.1.3 Baltimore-Washington International Airport Study

The Baltimore/Washington International Airport Capacity Task Force completed a study to determine when a new runway will be needed at BWI airport. An Airport Master Planning process will determine which of the alternatives should proceed for further capacity, cost and environmental study. The task force is now in phase three of the project. In 2003, BWI released an evaluation of each proposed capacity improvement and simulations were conducted to further evaluate impacts associated with capacity solutions. In 2004, the task force will update the forecasts, conduct further capacity analysis, develop cost estimates and conduct environmental studies.

3.2.1.4 Philadelphia International Airport Simulation Study

The FAA's Modeling and Analysis Group, ACB-320, of the William J. Hughes Technical Center, has been tasked to conduct computer simulations at PHL airport to evaluate two proposed scenarios for runway development. The first involves a parallel concept, which will require the construction of an additional parallel runway to the existing airfield. The second is a diagonal concept involving the rotation of the airfield by approximately 30 degrees. Four runways would be constructed in addition to the relocation of the existing terminal area. Simulation results of the two concepts will be analyzed and compared. This analysis, which began in 2003, will be presented to PHL for their review in late 2004.

3.2.2 Capacity Benchmark Analysis Continues

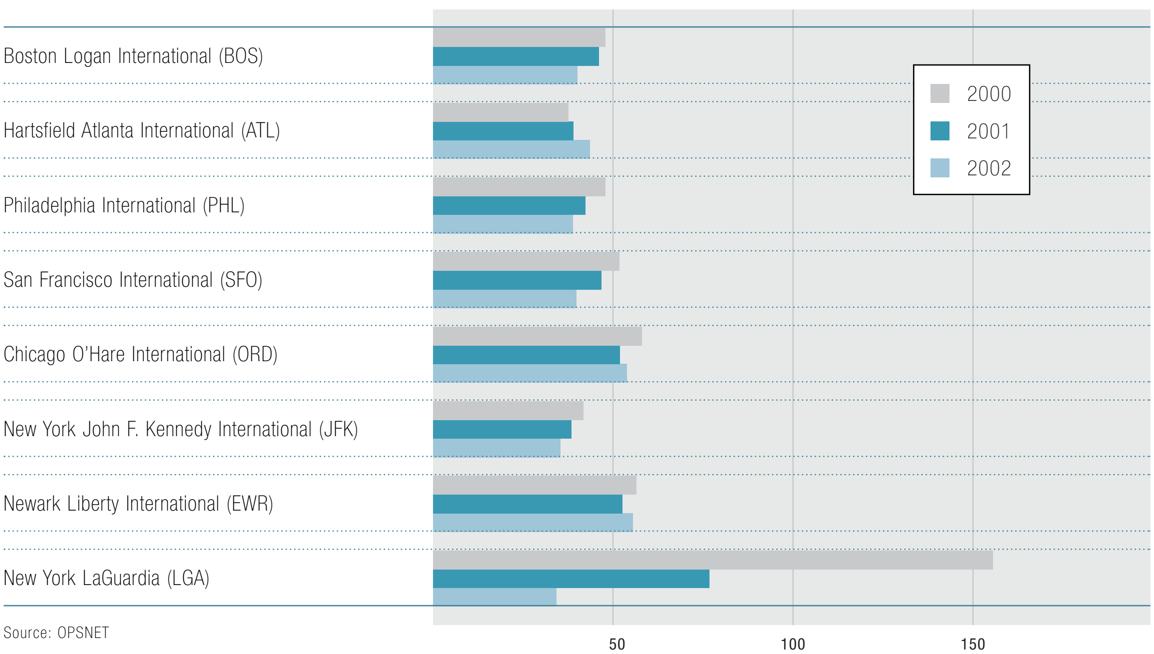
In 2001, the FAA issued the Airport Capacity Benchmark Report that analyzed capacity at 31 airports—the 30 busiest U.S. passenger airports and Memphis, a major cargo airport. Since the original report was published, the number of benchmarked airports has increased to 35 with the inclusion of the Cleveland, Ft. Lauderdale, Portland and Midway airports. The objective of the Benchmark Report was to document the number of flights these airports can handle under optimum and reduced weather conditions, and to project future capacity based upon plans for new runways, revised air traffic procedures, and technology improvements. This report was also prepared to understand the impact of airline scheduling and the relief that could be provided by the ATC modernization effort, new controller procedures and ground infrastructure in both the short and the long term.

Benchmark rates for each airport were derived based on observations of the air traffic controllers for a particular airport based on their experience in handling flights on a daily basis, and calculated using a computer model of airfield capacity. The observed and calculated estimates were compared to historical arrival and departure data to confirm their validity. Two benchmark rates were calculated for each airport: an optimum rate and a reduced rate. The optimum rate was defined as the maximum number of aircraft that can be routinely handled using visual approaches during periods of unlimited ceiling and visibility¸ when there are no traffic constraints in the en route system or airport terminal area, and aircraft operate using Visual Flight Rules (VFR). The reduced rate is defined as the number of aircraft that can be handled during peak periods of poor visibility when radar is required to ensure separation between aircraft, for the runway configuration most commonly used in adverse weather, when Instrument Flight Rule (IFR) conditions apply.

Once the benchmark rates were derived, they were then compared to the air carrier flight schedules to document how frequently scheduled demand exceeded the benchmark capacity under optimum and reduced weather conditions. While capacity benchmarks can be exceeded for a short period of time without producing a large number of delays, when the number of scheduled flights exceeds the benchmark capacity for sustained periods of time, delays are inevitable. When the report was originally produced, eight airports were defined as pacing airports. Those airports were selected given their significant passenger delays – where three percent or more of the operations experienced delays in excess of 15 minutes. Those airports included New York LaGuardia, Newark, New York Kennedy, Chicago O'Hare, San Francisco, Philadelphia, Atlanta and Boston.

The FAA has initiated an update of the Capacity Benchmark Report, scheduled to be complete in 2004. Additional airport configurations are being analyzed for progressively worse weather conditions. The 2001 benchmark capacity is also being adjusted due to the changes that have occurred in operating practices of the airlines, operational procedures, and ground infrastructure improvements. For example, the industry has experienced many changes in growth at secondary airports, fewer hubs as airlines restructure, and rolling hubs are becoming a standard practice. Figure 3-3 shows the delay rates per thousand operations at the 8 pacing airports for CY 2000 and CY 2002.

Figure 3-3 Capacity Benchmark Pacing Airports Delay Rate (2000 through 2002)



Source: OPSNET

Of the eight pacing airports, Atlanta was the only airport that experienced an increase in the delays per thousand operations in 2002 (43.9) as compared to 2000. The 17 percent increase in the delay rate in ATL (2002 as compared to 2000) was in spite of a 2 percent decrease in operations. The new runway, planned for completion in 2006, is expected to improve Atlanta's capacity benchmark substantially. In 2002, Newark's delays per thousand operations (55.7) was relatively flat as compared to the delay rate experienced in 2000 and registered the highest delays per operation of the eight pacing airports.

ASC has conducted capacity enhancement studies at 30 of the 35 benchmarked airports and continues with its plans to improve the operational efficiencies through a combination of airfield construction, enhanced technology, and improved procedures. Following in Figure 3-4 is an update of the studies that have recently been completed or that are underway.

Figure 3-4 OPSNET Delay Data for the Pacing Airports

Delays per 1,000 Operations	LGA	EWR	JFK	ORD	SFO	PHL	ATL	BOS
2000	155.9	56.2	41.8	57.7	51.9	47.5	37.4	48.2
2001	77.0	52.4	38.3	51.9	47.3	42.4	39.4	46.2
2002	34.4	55.7	34.9	54.1	39.9	39.3	43.9	40.7
Operations								
2000	392,047	457,182	358,951	908,977	430,554	483,567	913,449	508,283
2001	376,919	445,082	317,746	911,861	387,599	467,183	887,403	471,989
2002	367,656	411,239	301,160	922,787	351,453	467,717	890,923	404,649

Delays per 1,000 Operations	LGA	EWR	JFK	ORD	SFO	PHL	ATL	BOS
Change 2001 H/(L) than 2000	(51%)	(7%)	(8%)	(10%)	(9%)	(11%)	5%	(4%)
Change 2002 H/(L) than 2001	(27%)	6%	(8%)	4%	(14%)	(7%)	12%	(11%)
Change 2002 H/(L) than 2000	**(78%)**	**(1%)**	**(17%)**	**(6%)**	**(23%)**	**(17%)**	**17%**	**(16%)**
Operations								
Change 2001 H/(L) than 2000	(4%)	(3%)	(11%)	0%	(10%)	(3%)	(3%)	(7%)
Change 2002 H/(L) than 2001	(2%)	(8%)	(5%)	1%	(9%)	0%	0%	(14%)
Change 2002 H/(L) than 2000	**(6%)**	**(10%)**	**(16%)**	**2%**	**(18%)**	**(3%)**	**(2%)**	**(20%)**

Source: OPSNET

3.2.3 International Initiatives Address Global Capacity Enhancement

In addition to its roles as a focal point for airport capacity analyses and facilitation of strategic planning and performance measurement, ASC also coordinates international cooperative efforts to improve system capacity and efficiency. ASC is currently spearheading two international forums: the New Large Aircraft (NLA) Facilitation Group and the International Terminal Benchmark Study.

The New Large Aircraft Facilitation Group meets regularly to discuss issues related to airfield and operational modifications that may be required to allow the passenger and freighter versions of the A380 (currently in production) to operate at airports that do not currently meet national or international standards for such a large aircraft. Participants include representatives from the FAA and International Civil Aviation Organization (ICAO), as well as aircraft manufacturers, and airport, airline, and pilot organizations. As the A-380 will fly many trans-Atlantic and trans-Pacific routes, airports in Australia, Asia, Europe, and the U.S. that are likely to service the A-380 are working to make sure that they will be able to accommodate it without significant interruptions to other aircraft operations. Section 3.4.3 provides more information on the NLA Facilitation Group and the status of A380 airport modification issues.

The International Terminal Benchmark Study is pairing six U.S. terminal control facilities with facilities at similarly-sized airports in other countries for the purpose of studying the relative cost and efficiency of providing terminal and approach control services. The terminal facility pairings are: New Orleans and Dublin, Ireland; San Diego and Auckland; Portland and Copenhagen; Philadelphia and Frankfurt; Tampa and Sydney, and Dulles and Toronto. This study is a follow-up on a Eurocontrol study conducted in 2002 that focused on the comparative cost-effectiveness of en route facilities in Europe and the U.S. That study found that U.S. en route centers are more cost-effective than their European counterparts, and that U.S. en route controllers can handle more traffic when working at their maximum throughput. The terminal benchmark study will assist the U.S. and the other participating countries to better understand the factors that contribute to the provision of effective and efficient terminal ATC services, and will go beyond the en route study in its analysis of service cost drivers. The study will be completed in 2004.

3.2.4 Future Airport Capacity Studies

The FAA is now conducting a study entitled "A Look Into the Future: An Analysis of Airport Demand and Capacity Across the NAS," to identify airports where additional capacity development may be necessary. By combining a variety of data sources to estimate capacity with the socio-economic factors that affect passenger demand, the FAA will develop a comprehensive analysis of future capacity needs.

For the larger airports—those identified in the Operational Evolution Plan (OEP)—multiple criteria were used to identify needed capacity. The Annual Service Volume (ASV), simulation modeling, and updated capacity benchmark criteria needed to be in agreement in order for the airport to be identified as needing additional capacity. For the smaller airports, a simplified approach that relied on an airfield capacity model and socio-economic information was used.

The socio-economic factors being examined include an analysis of existing forecasts of economic and demographic data by metropolitan area. These forecasts were translated into estimates of future passenger demand that in turn were used to forecast future operations for those metropolitan areas. The study's scope goes beyond the OEP airports. However, sufficient funding and support from the community and political stakeholders are necessary for the study to continue. The results of the first phase of the study will be published in the 2004 ACE Plan.

3.3 Resources Affecting Airport Development

Federal interest in capital investment is guided by its commitment to ensure safety and security, preserve and enhance capacity, assist small airports, fund noise mitigation, and protect the environment.

Financing airport development projects is challenging in the current environment given increased operating costs and capital expenditures required to meet safety, security, and capacity requirements. These increased costs are combined with lower airline revenues and have caused some airports to defer and/or reduce certain capital expenditures and operating expenses.

Between 2001 and 2005, the FAA estimated airport capital development costs of $9 billion, annually. This estimate includes only projects eligible for federal funding. Airports Council International (ACI), a key organization that represents the airport industry, estimated costs of $15 billion, annually, which includes projects that may or may not be eligible for federal funding. Neither FAA's nor ACI's estimate includes funding for the terminal modification projects needed to accommodate the new explosives detection systems required to screen checked baggage. From 1999 through 2001, airports received an average of $12 billion annually for planned capital development. The primary source of funding capital development was bonds, followed by federal grants and Passenger Facility Charges (PFCs).[4]

4 "Airport and Airway Trust Fund: Financial Outlook is Positive, but the trust fund's balance would be affected if taxes were suspended," United States General Accounting Office, September 2003.

3.3.1 Airport Improvement Program

The FAA administers the Airport Improvement Program (AIP), a critical source of support for the nation's civilian air transportation infrastructure. The AIP federal grants are financed from taxes and fees collected from and dispensed to civilian airports from the Airport and Airway Trust Fund.

The Airport and Airway Trust Fund was created by Congress more than 30 years ago to fund improvements to airports and to the air traffic control system. It also provides funding for FAA operating expense. Revenues in the trust fund come primarily from airline user fees and/or fuel taxes. The Airport and Airway Trust Fund finances the Airport Improvement Program, the Facilities and Equipment Program, the Research, Engineering and Development Program, and the FAA Operations and Maintenance Programs (allocations vary, usually at 50 percent from the trust fund and the remainder from general funds).

The AIP program provides federal grants for the planning and development of eligible capital projects that support airport operations, including runways, taxiways, aprons, and noise abatement. Airport sponsors and non-federal contributors must provide the portion of the total project cost that is not funded with by AIP grants.

The FY 2003 request for funding is $3.4 billion in AIP grants, which was $0.1 billion higher than the previous fiscal year. Under AIR-21, the annual authorized levels for the Airport Improvement Program, (AIP) increased substantially, as AIP remains a critical source of support for the nation's civilian air transportation infrastructure.

Figure 3-5 Airport Improvement Program Funding History ($ in Billions)

Fiscal Year	Total Authorized	Appropriated
1994	3.0	1.8
1995	2.1	1.5
1996	2.2	1.5
1997	2.3	1.5
1998	2.3	1.7
1999	2.4	2.0
2000	2.5	1.9
2001	3.2	3.2
2002	3.3	3.3
2003	3.4	3.4

Airports that qualify for AIP funding must fit one of the following categories:

- Publicly owned commercial service airports that enplane 2,500 or more passengers annually and have scheduled service;
- Primary airports;
- Cargo service airports, served by aircraft that only provide air transportation of property with an aggregate annual landing weight of more than 100 million pounds;
- Relievers; or
- Remaining airports not specifically defined in the act, referred to as GA airports.

3.3.2 Passenger Facility Charges

Since 1992, airports have applied to the FAA to implement a Passenger Facility Charge (PFC) program. PFCs are fees paid by the enplaning passengers as an add-on to airfare. Originally, the maximum PFC was $3.00 per trip segment. The current maximum PFC is $4.50 per trip segment, with a cap of $18 for a roundtrip ticket. Every PFC application includes a summary of the projects that the airport intends to apply the PFCs remitted. Once authorized by the FAA, the PFC funding is collected by the airlines and remitted to the airport.

The FAA has approved over 300 airports to impose this fee, representing eventual collections of more than $43.8 billion over the next 40 years. Estimated PFC collections for FY 2003 are $2.1 billion. PFCs are used to finance capital improvements to address safety, capacity, airport access, and security needs, as well as noise reduction projects. The reduction in passengers has impacted the amount of funds collected by airports.

3.3.3 User Charges

In addition to airline revenues, there are several other users/tenants at an airport that generate revenue. Parking fees are typically the largest revenue source. Airlines carry a large share of airport expenses, through landing fees, facility rentals, and other costs. With lowered operations by airlines combined with fewer passengers, the level of revenue generated by airlines has been reduced. Airports also generate revenue through airport concessions (which include food, beverage, retail and car rental).

3.3.4 Airport Bonds

Airports rely on the issuance of bonds for a large portion of their capital development. This is particularly true for large and medium hub airports that rely on bonds as the largest source of funding. There are three classes of bonds issued by airports, which include:

- General Airport Revenue Bonds (GARBs),
- Special Facility Bonds, and
- Passenger Facility Charge Bonds.

Each type of bond has varying risk based on many factors including the issuing entity (airport or airline), level of origin and destination passengers, and whether an airport is dominated by a single airline. GARBs have a strong credit history since airline deregulation in 1978. These tax-exempt bonds are secured by an airport's future revenues and are issued directly by the airport entity. Used to finance airport facilities (including consolidated rental car facilities, maintenance hangers, and airport terminal buildings), special facility bonds are obligations of specific airlines (or other tenants) with the airport being a conduit issuer. Payment is made directly from the airline (or other tenants) directly to the bond holders. PFC bonds are backed by the passenger facility charges received, over time, by an airport.[5] With the reduction in passengers, less PFC revenue has been collected which has resulted in narrow margins as compared to the debt service.

5 "Airline Bankruptcies and Airport Bonds: 2003-2006," Fitch Ratings, July 21, 2003.

3.3.5 Other Sources of Funding

Airport staff personnel continuously explore alternate revenue generation methods and have employed innovative ways to generate revenue, reduce operating costs, or eliminate capital expenditures. In addition, private sources of funding may also be available through airport tenants, third-party developers and private entities.

3.4 Other Airport Development Activities

In an effort to explore all possibilities to achieve capacity enhancement, the FAA supports other types of programs that currently show or demonstrate the potential to improve system capacity in the future.

3.4.1 The Military Airport Program

The Military Airport Program (MAP) is another solution that can enhance airport system capacity and help to reduce flight delays at a relatively low cost, by converting military airfields to civilian use in or near major metropolitan areas. MAP is funded through the FAA's Airport Improvement Program. AIP funds are used to provide financial assistance for up to five years to the civilian sponsor of military airfields being converted to, or that have been converted to, civilian or joint-use airfields. MAP funds may be used for projects not generally funded by AIP that aid in the conversion process for civilian use. These projects include building or rehabilitating surface parking lots, fuel farms, hangars, utility systems, access roads, and cargo buildings.

A total of fifteen airports may participate in the program, including one general aviation airport. In 2003, three airports were added to the Map Program: Kalaeloa Airport, the former Naval Air Station Barbers Point, HI is a reliever airport for Honolulu International; Southern California Logistics Airport, Victorville, CA, is re-designated for a two year term, and Castle Airport, Atwater, CA, is the general aviation designation, designated for the first time for one year. Other airports that are currently in the MAP are: Guam International Airport, Guam; Sawyer Airport, Marquette, MI; Mid America Airport, Belleville, IL; Plattsburgh International Airport, Plattsburgh, NY; Cecil Field, Jacksonville, FL; Oskaloosa Regional Airport, Valparaiso, FL; Tipton Airport, Odenton, MD; Mather Airport, Sacramento, CA; March Inland Port, Riverside, CA; and Gray Army Airfield in Killeen, TX.

3.4.2 The Essential Air Service Program

The Essential Air Service Program (EAS) subsidizes air travel to approximately 100 rural communities, since the program was established with the enactment of the 1978 Airline Deregulation Act. The FAA reauthorization bill, known as Vision 100—Century of Aviation Reauthorization Act, has not yet been approved. The bill contains a $115 million annual funding request for the basic EAS program, as well as adding several new pilot programs that will help small airport communities increase their marketability.

3.4.3 Impact of New Transport Aircraft

The FAA's New Large Aircraft (NLA) Facilitation Group continues to meet and assess the potential impact of the Airbus A380. Ongoing issues under review include evaluating the structural and/or operational modifications that might be required to accommodate these aircraft at U.S. airports, and working with the International Civil Aviation Organization (ICAO) to ensure the development of harmonious standards. Airport development and the ability to integrate new capacity in the infrastructure are driven by the unique and varying characteristics of each surrounding airport community.

3.4.3.1 Aircraft Design Impacts Airport Design

Fleet composition at airports is becoming more complex. As air traffic continues to recover unevenly throughout the NAS, airport terminals must quickly adapt to the surge in commuter aircraft operating with mainline jets, while planning for the very few A380's expected in the air traffic system in the near future.

The study of the impact of A380's on airport design includes the evaluating such factors as large capacity aircraft requirements and what airports will need to service them, airside infrastructure impacts, airside capacity impacts, landside impacts, pavement design considerations, noise considerations and the systems approach (such as the impact on aircraft separation). Costly structural airport facility changes and airline personnel costs include supporting dual-level boarding gates, ticketing and service areas for handling 555 to 650 passengers, security processing and apron parking requirements.

A survey was conducted by the General Accounting Office to determine the costs for 14 U.S. airports making the required modifications to accommodate the A380/A380F.[6] While the airports estimated their collective costs at $2 billion, Airbus responded that their study placed the expense at $520 million. Some unresolved issues remain between the airports and Airbus, concerning what contributes to the variation in cost estimates, and under what conditions operational modifications such as restricting the A380's to certain taxiways could be employed to avoid large expenditures on airport upgrades.

Through the FAA-led work groups, a balance can be achieved between minimizing the adaptation costs sustained by airports, the impact on aerodynamic performance sought by aircraft manufacturers and the new operational cost-efficiencies needed by airlines. The ultimate benefit is that as air traffic levels return and surpass 2001 levels, high capacity airports could benefit from lower flight frequencies resulting from NLA operations, assuming that the passenger demand flows are historically consistent.

To give a perspective of how the dynamically-changing mix of passenger jet aircraft may impact airport development, the FAA has forecasted that the fleet will increase from 5,156 aircraft in 2002, to 8,095 by 2014. This group is expected to increase by an average of 21 aircraft per year (3.5 percent). It is also forecasted that there will be a decrease in the three-engine widebody fleet (the MD-11, DC10 and L-1011), from 92 aircraft in 2002 to 34 aircraft in 2014. Four-engine widebody aircraft, (the B-747 and A-340) are also expected to decline from 92 aircraft in 2002 to 78 aircraft in 2014, as two A 380's are scheduled for delivery in three years.[7] In Figure 3-6, wingspan lengths are portrayed according to aircraft type. The two-engine, widebody aircraft, specifically the A-300/310/330 and B-767/777 models, is the fastest growing group in the U.S. fleet.

6 The 14 surveyed airports are: Chicago O'Hare, New York Kennedy, Anchorage, San Francisco, Dallas-Ft. Worth, Indianapolis, Washington Dulles, Memphis, Atlanta, Houston Intercontinental, Orlando, Miami and Denver.

7 *FAA Aerospace Forecasts, Fiscal Years 2003-2014*, FAA-APO-03-1

Figure 3-6 FAA Design Group Aircraft Comparison by Wing Span Length

Design Group	Wing Span (ft.)	Aircraft Type
I	<49'	Cessna 152-210, Beechcraft A36
II	49'-79'	Saab 2000, EMB-120, Saab 340, Canadair RJ-100
III	79'-118'	Boeing 737, MD-80, Airbus 320
IV	118'-171'	Boeing 757, Boeing 767, Airbus A-300
V	171'-214'	Boeing 747, Boeing 777, MD-11, Airbus A-340
VI	214'-262'	A380-800

3.4.3.2 Airbus and Boeing's Perspectives of the Future

Among the nation's system of over 500 airports, there are 14 U.S. airports that are planning to make modifications to accommodate the A380's by 2010. Airbus is strategizing its aircraft design plans to meet the need for much larger aircraft serving connections through congested hubs, where landing slots are a premium. Currently Airbus has 121 firm orders plus 8 commitments, making a total of 129 aircraft, from 11 customers, planning for delivery of the first two A380's in 2006.

Boeing recently announced that it has elected to apply its new technology to the design of the 7E7, a fuel-efficient conventional jet that would seat 200-300 passengers, have a range of 6,600 nautical miles, and a 186-ft. wing span. Boeing's projections for a greater demand in point-to-point service have resulted in the development of the 7E7 jetliner that is due to start commercial flight operations in 2008. The Dreamliner would use 20 percent less fuel and cost 10 percent less to operate than current models. In 2001, Boeing scrapped plans for the 747 Jumbo Jet called the 747X, to build the Sonic Cruiser, which in turn was terminated in 2002 due to the economic downturn and overall drop in air traffic.